

**REMARKS**

**I. Claim Rejections - 35 USC § 103**

***Requirements for Prima Facie Obviousness***

The obligation of the examiner to go forward and produce reasoning and evidence in support of obviousness is clearly defined at M.P.E.P. §2142:

"The examiner bears the initial burden of factually supporting any *prima facie* conclusion of obviousness. If the examiner does not produce a *prima facie* case, the applicant is under no obligation to submit evidence of nonobviousness."

The U.S. Supreme Court ruling of April 30, 2007 (*KSR Int'l v. Teleflex Inc.*) states:

"The TSM test captures a helpful insight: A patent composed of several elements is not proved obvious merely by demonstrating that each element was, independently, known in the prior art. Although common sense directs caution as to a patent application claiming as innovation the combination of two known devices according to their established functions, it can be important to identify a reason that would have prompted a person of ordinary skill in the art to combine the elements as the new invention does."

"To facilitate review, this analysis should be made explicit."

The U.S. Supreme Court ruling states that it is important to identify a *reason* that would have prompted a person to combine the elements and to make that analysis *explicit*. MPEP §2143 sets out the further basic criteria to establish a *prima facie* case of obviousness:

1. a reasonable expectation of success; and
2. the teaching or suggestion of all the claim limitations by the prior art reference (or references when combined).

It follows that in the absence of such a *prima facie* showing of obviousness by the Examiner (assuming there are no objections or other grounds for rejection) and of a *prima facie* showing by the Examiner of a *reason* to combine the references, an applicant is entitled to grant of a patent. Thus, in order to support an obviousness rejection, the Examiner is obliged to produce evidence compelling a conclusion that the basic criterion has been met.

***Biemond et al. in view of Owens et al., Lavenier and Okuda***

The Examiner rejected claims 1-2, 5-8, 12-15, and 19-20 under 35 U.S.C. § 103(a) as being unpatentable over Biemond in view of Owens (citing "Computer Vision on the MGAP"), and in further view of Lavenier (citing "Advanced Systolic Design") and further in view of Okuda et al. (U.S. Patent No. 6,493,467), hereinafter referred to as "Okuda".

Regarding claim 1(7), the Examiner argued that Biemond describes an iterative method for image deblurring performed by a computing system used to process the image, but admitted Biemond does not explicitly teach the downloading of a video image, the use of a systolic array processor to perform the deblurring method. The Examiner argued that Owens teaches the downloading of an image for further processing (citing paragraph 2 of the "Introduction" section). The Examiner argued that Owens further teaches the use of a systolic array of interconnected logic blocks (Digital Processors) for the parallel processing of images (stating deblurring is image processing)(citing sections 2.1 and 3.1). The Examiner argued that Owens shows the adjacent interconnections of the processing array in which the plurality of pixels are communicated to their respective Digital Processors (processing logic blocks) (citing FIG. 4).

The Examiner argued that it would have been obvious to one of ordinary skill in the art at the time of the invention to use the known systolic array disclosed by Owens with the known iterative image deblurring method disclosed by Biemond

according to Lavenier that teaches the use of iterative methods on systolic array (citing Lavenier, section 5.2). The Examiner argued therefore that the combination provides the predictable result of iterative image deblurring according to the known method of Biemond using the known device of a systolic array as disclosed by Owens and Lavenier.

The Examiner admitted that neither Owens, nor Lavenier, nor Biemond discuss the processing of video images. However, the Examiner argued that a video is a series of frames (images) and a method such as is taught by Biemond that operates on a single image can clearly be used to operate on a plurality of images sequentially. Thus, the Examiner argued that the method taught by Biemond in view of Owens and Lavenier for deblurring an image can also be used on a sequence of images (video).

The Examiner argued that Biemond teaches the iterative deblurring method in the section entitled "Iterative Solutions" (citing Biemond, page 865) using three sets of data each dependent on the particular pixel data they correspond to (the Examiner argued that thus each set is an image "plane" because it varies with x and y, where x and y are the pixel indices). The Examiner argued that the method and system disclosed by Biemond in view of Owens and Lavenier correct the image at some rate but admitted they do not specify that it is at the frame rate of the video (i.e. real time). However, the Examiner argued that Okuda teaches a parallel processing system (citing Okuda col. 3, lines 29-24 and col. 97, lines 8-13) that performs real-time processing on image data by utilizing a parallel processing system.

The Examiner argued that thus, as evidenced by Okuda, one of ordinary skill in the art at the time of the invention would have expected the reduction in image processing time when utilizing a parallel processing system and would have desired the image processing to occur in real-time. The Examiner argued that therefore, it would have been obvious to one of ordinary skill in the art to modify the parallel processing system and method of Biemond, Owens and Lavenier with the teachings

of Okuda to process image data in real-time. The Examiner argued that real-time processing allows for real-time video processing since a video is a sequence of single images.

The Examiner admitted that Owens and Biemond do not explicitly teach the uploading of the blurred image. The Examiner takes official notice that the uploading of the deblurred (processed) image is notoriously well known in the art. The Examiner argued that since the purpose of deblurring the image is to produce a deblurred image for display or further processing, and thus would have been obvious to one of ordinary skill in the art to store or upload the processed image for retrieval or display.

The Applicant notes that claims 1-6 have been canceled with this amendment rendering moot the Examiner's arguments against these claims. The Examiner argued that claims 7-8, 12-13, 14-15, and 19-20 claim the corresponding device that performs the method of claims 1-2, and 5-6. The Applicant will address the Examiner's arguments as they pertain to claims 7-20 herein.

The Applicant respectfully disagrees with the Examiner's assessments and notes that the limitations of claim 7, as submitted before, are not disclosed in the prior art. The Applicant's invention is a method and system for *deblurring* video images, wherein the video image is deblurred by the Applicant's invention one still image of the video image at a time wherein the image is deblurred such that the iterative update occurs within the video frame update rate. The cited prior art does not disclose this limitation.

The Examiner has admitted that the prior art does not disclose deblurring of a *video* image; one of the limitations of the Applicant's invention. The Examiner argues that video images are a series of frames and a method such as taught by Biemond which operates on a *single* image would operate on a *plurality* of images. The Examiner has not provided evidence of such a conclusion. The Examiner has included the Okuda reference in the current office action, stating that Okuda

performs real-time processing on image data by utilizing a parallel processing system.

The Applicant has argued previously that Okuda, however, does not disclose *deblurring* of a video image, as in the Applicant's invention. Okuda does indeed disclose processing of an image but defines this "processing" as color correction of the image, as shown in col. 1, lines 18-22 and col. 3, lines 22-28. The Examiner has not stated how the single image deblurring methods of Biemond in view of Owens and Lavenier would combine with the color processing of Okuda to perform video image deblurring. Okuda may be able to process the color correction in a video at "real-time" but this does not make the combination of Okuda and Biemond in view of Owens and Lavenier a *video image deblurring method*. Okuda simply discloses that it would be desirable to process video images in real-time without disclosing how video image *deblurring* would be performed. Okuda provides a motivation to process the video images in real-time without disclosing how this would actually be performed on the Biemond, Owens and Lavenier combination. Combining the processing method of Okuda with Biemond and Owens does not make Biemond in view of Owens capable of processing deblurring of video images within the video frame update rate. The Examiner has simply stated that the parallel processing system of Okuda would be capable of processing deblurring of video images with the method of Biemond in view of Owens and Lavenier without any evidence of this conclusion.

The Examiner has argued that motivation for the combinations has been provided (office action, page 7 and 8). The Applicant notes that the motivation (i.e. explicit rationale for the combination) provided by the Examiner appears to be that (in the Examiner's argument) that all claim elements are disclosed in the various references and therefore the combination is obvious. The Applicant reminds the Examiner that the U.S. Supreme Court has ruled that it remains *legally insufficient to conclude that a claim is obvious just because each feature of the claim can be independently shown in the prior art*. The Applicant furthermore submits that the

claimed invention is not a predictable use of prior art elements as the Applicant has shown that the prior art requires supervision and is unacceptable for an embedded implementation in a systolic array processor (Applicant's paragraph [0013]).

The Applicant further notes that claim 7 has been amended to include the limitation wherein the processor means is adapted to process a feedback of a blurred image predication error based on a first localized FIR convolution operator and a feedback of a past deblurred image estimate based on a second localized FIR convolution operator by sequentially exchanging data. This is disclosed in paragraphs [0018] and [0019].

The prior art references do not disclose these processing terms of the feedback of a blurred image prediction error and a past blurred image estimate and therefore do not disclose each and every limitation of the Applicant's claim 7.

Therefore, Biemond in view of Owens, Lavenier and Okuda fails in the aforementioned *prima facie* obviousness test as each and every limitation of the Applicant's claim 7 is not disclosed. Additionally, the Examiner has not provided any explicit reason to combine the Biemond, Owens, Lavenier and Okuda references as required by the U.S. Supreme Court.

Based on the foregoing, the Applicant respectfully requests that the 35 U.S.C. §103(a) rejections of claim 7 based on the Biemond, Owens, Lavenier and Okuda references be withdrawn.

Regarding claim 8, the Examiner argued that Owens and Lavenier disclose the implementation of an iterative method on a systolic array as is discussed in rejection of claim 7. The Examiner argued that Biemond teaches an iterative method for deblurring images (citing Biemond, pages 865-868 under the section titled "C. Iterative Solutions") using error feedback and past deblurred image estimate feedback (citing equations 56 and 57 on page 865). Furthermore, the Examiner argued that as evidenced by Lavenier (citing Lavenier section 5.2), the implementation of iterative algorithms on a processing array was well known to one of ordinary skill in the art.

The Applicant respectfully disagrees with this assessment and notes that the argument presented above against the rejection of claim 7 applies equally against the rejection of dependent claim 8.

Therefore, Biemond in view of Owens, Lavenier and Okuda fails in the aforementioned *prima facie* obviousness test as each and every limitation of the Applicant's claim 8 is not disclosed. Additionally, the Examiner has not provided any motivation to combine Biemond in view of Owens, Lavenier and Okuda references nor has the Examiner made an explicit reasoning why one of ordinary skill in the art would combine the references.

Based on the foregoing, the Applicant respectfully requests that the 35 U.S.C. §103(a) rejection of claim 8 based on Biemond in view of Owens, Lavenier and Okuda be withdrawn.

Regarding claim 5 (19), the Examiner argued that Biemond in view of Owens and Lavenier, as applied to claim 1, teach the deblurring of an image using a systolic processor array. The Examiner argued that Owens teaches the implementation of image processing methods using systolic array processors for image processing (citing Owens, final line of the second paragraph on page 338) that at a least one pixel is operated on per processor. Thus, the Examiner argued that, as is taught by Owens, the pixels are grouped into groups of pixels such that at least one pixel is operated on per processor.

Regarding claim 6 (claims 13 and 20), the Examiner argued that filtering and image processing methods such as deblurring are done locally by operating on groups of adjacent pixels. The Examiner argued that Owens discloses an example of such a grouping (citing Owens section 3.1 on page 338) wherein Owens disclosed the use of 3x3 masks applied to the image and hence it was known to group and process pixels in a processing array.

The Examiner argued that claims 7-8, 12-13, 14-15, and 19-20 claim the corresponding device that performs the method of claims 1-2, and 5-6. The Examiner argued that as per the rejections of claims 1-2 and 5-6, the method has

been disclosed by Biemond in view of Owens and Lavenier. Furthermore, the Examiner argued that the device has been disclosed since Owens and Lavenier have disclosed the implementation of such methods on a systolic array device.

The Applicant respectfully disagrees with this assessment and notes that the argument presented above against the rejection of claim 1 applies equally against the rejection of claims 5-8, 12-15 and 19-20.

Therefore, Biemond in view of Owens, Lavenier and Okuda fails in the aforementioned *prima facie* obviousness test as each and every limitation of the Applicant's claims 7-8, 12-15 and 19-20 is not disclosed. Additionally, the Examiner has not provided any motivation to combine Biemond in view of Owens, Lavenier and Okuda nor has the Examiner made an explicit reasoning why one of ordinary skill in the art would combine the references.

Based on the foregoing, the Applicant respectfully requests that the 35 U.S.C. §103(a) rejections of claims 7-8, 12-15 and 19-20 based on Biemond in view of Owens, Lavenier and Okuda be withdrawn.

***Biemond in view of Owens, Lavenier, Okuda and Gorinevsky***

The Examiner rejected claims 3, 9-10, and 16-17 under 35 U.S.C. § 103(a) as being unpatentable over Biemond in view of Owens, Lavenier and Okuda as applied to claims 1-2 and 5 above, and in further view of Gorinevsky (citing "Optimization-based Tuning of Low-bandwidth Control in Spatially Distributed Systems").

The Applicant notes that claim 3 has been canceled with this amendment rendering moot the Examiner's argument against this claim. The Applicant will address the Examiner's arguments as they pertain to claims 9 and 16 herein.

Regarding claim 3 (claims 9 and 16), the Examiner argued that Biemond identifies the existence of regularization error and discloses a solution of the regularization error (citing Biemond section 5, page 868). The Examiner argued that the term  $S^*u(n)$  as defined by applicant was known to one of ordinary skill in



the art as a solution to the regularization problem. The Examiner admitted that Biemond does not teach the regularization method shown by applicant. However, the Examiner argued that Gorinevsky (citing Gorinevsky sections 1 and 3) teaches a filter that improves the spatial response (reduces regularization error) of the system. The Examiner argued that it would have been obvious to one of ordinary skill in the art to substitute the regularization method as taught by Gorinevsky for the regularization method taught by Biemond with a reasonable expectation of success while maintaining or improving the spatial response (reduction of regularization error) provided by the method taught by Biemond. Furthermore, the Examiner argued that in the same sections of Gorinevsky, the use of the term K has also been disclosed.

The Applicant respectfully disagrees with this assessment and notes that the argument presented above against the rejection of claim 7 applies equally against the rejection of dependent claims 9 and 16. Additionally, Biemond in view of Owens, Lavenier, Okuda and Gorinevsky does not disclose the limitations of claims 9 and 16.

The Examiner has admitted that Biemond does not utilize or disclose the algorithm in the method of claims 9 and 16, however, the Examiner argues that the term  $S * u(n)$  is known as a solution to the regularization problem and Gorinevsky teaches a filter that improves the spatial response of the system. The Examiner continues, stating that Gorinevsky teaches the term K. The Examiner does not state that this is the same algorithm as in claim 9 and 16, however. Specifically, the algorithm:  $u(n + 1) = u(n) - K * (H * u(n) - y_b) - S * u(n)$  is not disclosed in the prior art and the Examiner has not stated or argued that it is disclosed. Individual components of the may be disclosed in the references, but the algorithm itself is not disclosed. The Examiner's cited equations in Biemond (equations 56 and 57 on page 865) are equations of the Van Cittert method. This method is disclosed as prior art in the Applicant's specification in paragraph [0010] whereas the

Applicant's paragraphs [0013] - [0016] disclose the problems in the prior art methods solved by the Applicant's invention.

Therefore, Biemond in view of Owens, Lavenier, Okuda and Gorinevsky fails in the aforementioned *prima facie* obviousness test as each and every limitation of the Applicant's claim 9 and 16 is not disclosed. Additionally, the Examiner has not provided any motivation to combine the Biemond, Owens, Lavenier, Okuda and Gorinevsky references nor has the Examiner made an *explicit* reasoning why one of ordinary skill in the art would combine the references.

Based on the foregoing, the Applicant respectfully requests that the 35 U.S.C. §103(a) rejections of claim 9 and 16 based on the Biemond, Owens, Lavenier, Okuda and Gorinevsky references be withdrawn.

Regarding claims 10 and 17, the Examiner admitted that Owens and Lavenier do not explicitly teach the preloading of the information into each processing logic block of the array. However, the Examiner argued that as is evidenced by Owens (citing Owens second paragraph of page 338) the addition, subtraction, multiplication,...etc. are performed on the received pixel data. The Examiner argued that in order to perform these operations the values intended to be used in these operations must be stored in the processing elements. Furthermore, the Examiner argued that as per the disclosure of Lavenier (citing Lavenier section 5.2) the weights of matrix  $W$  are stored in the processing units so that they can be used to multiply the values of the input ( $X$ ). Thus, the Examiner argued that it is clear from this disclosure that known constants are stored in the processing units (logic blocks) in order to perform the predetermined operations.

The Applicant respectfully disagrees with this assessment and notes that the argument presented above against the rejection of claim 7 and 14 applies equally against the rejection of dependent claims 10 and 17.

The Examiner has admitted that the prior art references do not disclose the claim 10 and 17 limitations merely stating that other values are stored in the processing blocks. The Applicant notes that  $K$  comprises a feedback update

operator with a convolution kernel  $k(m,n)$  and  $S$  comprises a smoothing operator with a convolution kernel  $s(m,n)$  and  $H$  is the assumed point spread function. These operators are preloaded into each of the processing array logic blocks. The Examiner does not try to explain how it would be obvious to one of ordinary skill in the art to preload the operators  $H$ ,  $K$  and  $S$  into each processing logic block of the array.

Therefore, Biemond in view of Owens, Lavenier, Okuda and Gorinevsky fails in the aforementioned *prima facie* obviousness test as each and every limitation of the Applicant's claims 10 and 17 is not disclosed.

Based on the foregoing, the Applicant respectfully requests that the 35 U.S.C. §103(a) rejections of claims 10 and 17 based on the Biemond, Owens, Lavenier, Okuda and Gorinevsky references be withdrawn.

***Biemond in view of Owens, Lavenier, Gorinevsky and Dowski***

The Examiner rejected claims 4, 11, and 18 under 35 U.S.C. §103(a) as being unpatentable over Biemond in view of Owens, Lavenier, Okuda and Gorinevsky as applied to claims 3, 9-10, and 16-17 in further view of Dowski (U.S. Patent Publication No. 2003/0169944).

Regarding claim 4, the Examiner argued that claim 4 is a modification of the method of claim 3 wherein the deblurring is performed on each color space separately. The Examiner argued that Biemond discusses image processing, but admitted Biemond does not go into the particulars of color space processing. However, the Examiner argued that as evidenced by Dowski (citing Dowski paragraph [0018]) the method of dividing an image into its color spaces and then deblurring each of the color spaces was known to one of ordinary skill in the art. Furthermore, the Examiner argued that the teaching of Dowski shows that one of ordinary skill in the art knew how to apply image-filtering processes such as deblurring to each color channel. The Examiner argued that given that Biemond teaches the deblurring of at least a grayscale image and that Dowski teaches the

application of a single channel deblurring process to each of the color channels. The Examiner argued that it would have been obvious to one of ordinary skill in the art to combine the teachings of Dowski with Biemond to perform the deblurring technique as taught by Biemond on each channel of a color image (citing as taught by Dowski) and yield the expected result of a deblurred color image.

The Examiner argued that claims 11 and 18 claim the corresponding device that performs the method of claim 4. The Examiner argued that as per the rejections of claims 1-4, the method has been disclosed by Biemond in view of Owens, Lavenier, Gorinevsky, Okuda and Dowski. Furthermore, the Examiner argued that the device has been disclosed since Owens and Lavenier have disclosed the implementation of such methods on a systolic array device.

The Applicant notes that claim 4 has been canceled with this amendment rendering the Examiner's argument against this claim. Furthermore, the Applicant respectfully disagrees with this assessment and notes that the argument presented above against the rejection of claims 7 and 14 applies equally against the rejection of dependent claims 11 and 18.

Therefore, Biemond in view of Owens, Lavenier, Okuda, Gorinevsky and Dowski fails in the aforementioned *prima facie* obviousness test as each and every limitation of the Applicant's claims 4, 11 and 18 is not disclosed.

Based on the foregoing, the Applicant respectfully requests that the 35 U.S.C. §103(a) rejections of claims 4, 11 and 18 based on the Biemond, Owens, Lavenier, Gorinevsky, Okuda and Dowski references be withdrawn.

## **II. Newly Presented Claims**

The Applicant notes that new claims 21 - 26 have been added with this amendment. The support for these claims is disclosed in the Applicant's specification in paragraphs [0018] and [0019]. The Applicant respectfully requests the allowance of these claims.



**III. Conclusion**

In view of the foregoing discussion, the Applicant has responded to each and every rejection of the Official Action. The Applicant has clarified the structural distinctions of the present invention. Applicant respectfully requests the withdrawal of the rejections under 35 U.S.C. §103 based on the preceding remarks. Reconsideration and allowance of Applicant's application is also respectfully solicited. A Request for Continued Examination (RCE) under 37 CFR 1.114 is also submitted herewith, including the RCE fee of \$810.

Should there be any outstanding matters that need to be resolved, the Examiner is respectfully requested to contact the undersigned representative to conduct an interview in an effort to expedite prosecution in connection with the present application.

Respectfully submitted,



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Kermit Lopez  
Attorney for Applicants  
Registration No. 41,953  
ORTIZ & LOPEZ, PLLC  
P.O. Box 4484  
Albuquerque, NM 87196-4484  
Tel. 505-314-1312